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MANIFESTATIONS OF CHOLERA

IN SHIPS AT SEA,

AND THEIR CONNECTIONS WITH

OUTBREAKS ON LAND.

BY

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[Reprinted from the TRANSACTIONS OF THE EPIDEMIOLOGICAL
SOCIETY OF LONDON, N.S., Vol. V.]

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A MAP SHEWING THE PROGRESS OF CHOLERA IN SHIPS AT SEA AND THEIR CONNECTION WITH OUTBREAKS ON LAND, BY ROBERT LAWSON, INSPECTOR GENERAL OF HOSPITALS.



ON THE MANIFESTATIONS OF CHOLERA IN SHIPS AT SEA, AND THEIR CONNECTIONS WITH OUTBREAKS ON LAND.

By ROBERT LAWSON, LL.D., Q.H.P., Inspector-General of Hospitals.

(Read: April 20th, 1892.)

THE appearance of cholera, in ships at sea, is quite as interesting as its progress over land, and is even of more importance in indicating the factors by which it is diffused. I have been collecting information on this question for thirty years past, and have, on two occasions, placed some of the facts before the Epidemiological Society.* In this I will deal with the connection of the outbreaks in ships, with the indications of the disease on either side of that part of the ocean where they occur.

The first point which presents itself here, for consideration, is the relation between what is generally designated cholera nostras, and the malignant form of the disease common during epidemics. There is evidently a difference between these two, of much the same character as there is between benign plague and the pestilential form of that disease, or even between ordinary intermittent and severe remittent fever; but, epidemiologically, these all resemble each other in this respect, that, when prevailing, there is a central area occupied by the more severe form which is surrounded, in front and on either side, by a zone of the milder disease, often to a great extent. Under such circumstances, a number of cases of the malignant form occur sporadically among the slighter, and, as the edge of the central area is approached, these frequently occur in groups, without being actually in continuation with it. As the epidemic pursues its course, it occupies the portion of this zone in front of it, either at a later period in the same year, or in the following one, while, in those portions on either side of the area of its full development, the cholera nostras and the sporadic malignant cases increase

* Epidemiological Society's *Transactions*, vol. iii, p. 288, and New Series, vol. iv, p. 102.

as the central body of the epidemic passes, and finally ceases as it disappears.

Anyone anxious for information on these points, can obtain it by comparing the deaths from cholera in the annual returns of the causes of death in the Reports of the Registrar-General of England and Wales, of Scotland, and of Ireland, for a series of years, in connection with the prevalence of that disease on the adjacent portions of Europe for the same period. The following instances may be here detailed. In 1865 cholera was prevalent in the Mediterranean, and, in the course of the summer, advanced to the northward, through France, reaching Paris on August 24th. Cholera nostras, which had caused 45 deaths per million in England and Wales in 1864, rose to 64 in 1865, and embraced an unusual number of sporadic malignant cases. Dr. Wilkes treated one in Guy's Hospital early in July, and there was another on 27th June in the Borough, which proved fatal on the 28th. In Scotland, where the deaths returned as cholera in 1864 were two in 100,000, these rose to seven in the same number of persons in 1865. And in Denmark and South of Sweden cholera, accompanied by an unusual number of the malignant form, was much more common in 1865 than for several years previously. Through this extensive area, therefore, indications of the presence and activity of the causes of malignant cholera were more pronounced in 1865 than the previous year, a position accentuated by the outbreaks at Southampton, and Theydon Bois in Essex; though nowhere did the approaching epidemic reach them until 1866, when it invaded Great Britain and the whole of Western Europe up to the Baltic.

The following also may be noticed. In 1837 cholera had been epidemic in part of Italy, Sicily, and at Malta, and had also prevailed in Russia and Germany. In August, four cases and two deaths occurred in the *Dreadnought* hospital-ship in the Thames; and in October, between the 8th and 28th, there was another outbreak in her, during which twenty were attacked, of whom twelve died, when the disease ceased. In 1837, also, there was a sporadic case near Edinburgh in September, which recovered: another in November, and a third in December, both of which proved fatal. There was a severe outbreak in the House of Industry at Coventry between 7th January and 5th February 1838, in which there were fifty deaths from cholera.

In 1859, when cholera was epidemic along the western

coast of Europe, from South of Spain to Sweden, there was a limited outbreak at the coastguard-station on Southampton Water, near Netley, between 3rd and 17th July. In the Marshalsea prison at Manchester, the prisoners were attacked by choleraic diarrhoea on 28th September, and, out of the 466 in confinement, 196 (including both males and females) were reported sick on 28th, 56 on 29th, 9 on 30th, 5 on 1st October, and 2 on 2nd—256 in all. The water was supplied from the Salford Waterworks, and was stored in the gaol in two cisterns—one attached to the kitchen for the preparation of food for the prisoners, the other for the officers of the establishment. The weather was very hot at the time, and the water in the first named, on the day of the outbreak, was found of a yellow colour and insipid in flavour, and, on examination, the overflow-pipe, which opened into one of the sewers, was found untrapped. The water in the other cistern was found clean and refreshing, and none of the fifty-three officers and others on the premises, who did not employ the water from the kitchen cistern, were affected. In addition to these instances, twelve persons died of cholera, between 1st and 17th October, at Glass Houghton, a village near Pontefract in Yorkshire. There was also a sharp outbreak of cholera in the end of summer at Wick, in the North of Scotland. The deaths from cholera in England, which were 34 per million living in 1858, rose to 45 in 1859, and in 1860 they fell to 14; in Scotland the ratios per 100,000 living in the corresponding years were 3, 5, and 2, showing the same fluctuation, and practically to the same extent. Had space permitted, a great many more instances of a similar description could have been given; but those detailed above are sufficient to show that the cholera nostras and the sporadic cases in the malignant form, surrounding the area occupied by an epidemic of cholera, are under the influence of the factors causing that epidemic, and form part of the natural history of the disease, which cannot be overlooked when its mode of diffusion comes to be investigated.

A very important observation, with reference to cholera, was made by the late Dr. Prout sixty years ago, which epidemiologists of the present day seem to have altogether overlooked. Dr. Prout had been engaged, in London, for about six weeks, in ascertaining the weight of a given bulk of atmospheric air, under the same conditions as to temperature and pressure, when, on 9th February 1832, he found it had acquired a small, though sensible, increase. This,

though not quite so great as on the first day, continued while the observations were made, which was for six weeks longer. About the 9th February the wind, which had previously been westerly, veered round to easterly, and remained chiefly in that quarter till the end of the month. Now, precisely on the change of wind the first cases of epidemic cholera were reported in London, and from that time the disease continued to spread. Dr. Prout ascribed the increased weight to the admixture of some form of malaria, heavier than air, but, as the matter then appeared to him, he thought it more perhaps than could be safely maintained that the cholera was due to this foreign matter, though he states his impression that epidemics of that disease are due to such a cause.

Dr. Bryden, in his *Report on the General Aspects of Epidemic Cholera in 1869*, published as a sequel to his *Report on the Cholera of 1866-68*, gives (at p. 54) the following details with reference to the coolies who proceeded from Calcutta to Mauritius in 1850-60, and to the West Indies in 1861-69. For Mauritius 105,382 embarked, of whom 22,077 in ships that became affected with cholera, and of these 288 died of it; thus 21 per cent. of the total number embarked were exposed to the disease, and 13.0 per 1,000 of those so exposed died of it. For the West Indies 72,681 embarked, 8,284 of them in ships that subsequently became affected with cholera, and 89 died of it; 11.4 per cent of those embarked were therefore exposed to cholera, of whom 10.7 per 1,000 died of it.

The Sanitary Commissioner with the Government of India, in his Report for 1881, has given (at p. 135) a statement showing that 222 vessels, carrying 129,527 coolies, left Calcutta for Mauritius, Natal, and the West Indies from 1871 to 1880. Cholera appeared in thirty-two of these, with 14,572 coolies on board, being 14.3 per cent. of the total, and of these 181, or 12.3 per 1,000, died of that disease. Though the percentage of ships attacked in the first period was nearly double of that in the following two, the mortality per 1,000 exposed was nearly the same in all, showing the incidence of the disease to have been very nearly the same in each period.

In the statement for 1871-80 the deaths from cholera each day after embarkation are given for each ship up to the twentieth, and from the twenty-first onwards in one group. The first death did not occur on fifth or sixth day after embarking, nor on the seventeenth, eighteenth, nineteenth, or twentieth days. There were thus three

periods of attack, the first extending from the first to the fourth day, the second from the seventh to the sixteenth day, and the third from the twenty-first onwards. In the Table, page 86, are given the names of the thirty-two vessels, the number of coolies embarked in each, with the date, the deaths from cholera in each of the three periods, with their total in each ship. Also the dates of landing and the points of disembarkation.

Sailing ships, proceeding from Calcutta to the southward of the equator, go along the meridian of 90 deg. E. as nearly as they can, so as to cross the line from that to 93 deg. or 94 deg. E. After passing through the variable winds met with between the equator and 4 deg. to 12 deg. S. (according to season), they reach the S.E. trade, which is a fair wind for those going westward, but those for the east have to pass through the trade, to avail themselves of the westerly winds which prevail to the south of it.

After embarking their emigrants, the sailing ships—since 1871, at least—seem to have been towed out of the river, so as to be in the open sea on the second day; in estimating their position, subsequently, no material error will be committed if the seventh, sixteenth, and twenty-first days after embarkation be reckoned as the sixth, fifteenth, and twentieth days after leaving the land. Employing the data in my possession, the approximate latitude of sailing ships from Calcutta, on the sixth day at sea, is about 15 deg. N.; on the fifteenth day about 7 deg. N.; and on the twentieth day about 1 deg. N., with an extreme variation in individual cases of about 3 deg. either way. It thus appears that, in sailing vessels, the first of the three outbreaks noticed above must have occurred near the 90 deg. meridian, and to the north of about 16 deg. N.; the second from 15 deg. N. to 7 deg. N.; and the third about 1 deg. N. onwards; and the factors which determine them must have become active about these positions respectively. The deaths in the first group, being within the usual period of incubation, may be due to exposure on shore; but those in the second, and still more in the third groups, cannot be explained in this way.

Referring to the Table,* now it is seen that from 11th September 1871 to 3rd November 1874, a period of three consecutive years, twenty-five ships were attacked with cholera, while from 1875 to 1878 inclusive, the four

* This Table is a re-arrangement of the facts contained in that at p. 114 of vol. iv of the *Epidemiological Transactions*, New Series, to bring out relations with the land these do not deal with.

TABLE I.

*Abstract of Coolie Ships which sailed from Calcutta during 1871-80
in which Cholera appeared.*

Ships' Names.	Numbers embarked.	Date of Embarkation.	Deaths from Cholera.			Total.	Date of Dis-embarkation.	Destination.
			1st Period.	2nd Period.	3rd Period.			
Adamant	343	Sept. 22, 1871	—	1	1	2	Dec. 23, 1871	Demerara.
Medea	431	Nov. 8, „	—	2	9	11	Jan. 26, 1872	„
Poonah	506	Feb. 22, 1872	—	13	5	18	June 18, 1872	„
Fateh Salam ...	275	Mar. 7, „	5	—	—	5	Apr. 13, „	Mauritius.
Humber	462	Mar. 31, „	—	—	1	1	Sept. 9, „	Jamaica.
Wellesley	334	May 14, „	—	1	—	1	June 26, „	Mauritius.
Woodburn	577	Aug. 1, „	—	5	—	5	Nov. 3, „	Trinidad.
Kate Killock ...	456	Aug. 5, „	—	14	—	14	Nov. 12, „	Demerara.
Sea Queen	328	Sept. 4, „	1	1	—	2	Dec. 2, „	Jamaica.
Neva	484	Nov. 23, „	1	3	—	4	Feb. 25, 1873	Demerara.
Shah Jehan	285	Mar. 30, 1873	—	—	2	2	May 8, 1873	Mauritius.
Allumghier	340	May 28, „	—	1	—	1	June 30, „	„
Enmore (steamer)	577	July 4, „	2	3	5	10	Aug. 25, „	Demerara.
Merchantman ...	383	July 25, „	—	4	—	4	Sept. 1, „	Mauritius.
Syria	438	Aug. 24, „	—	4	2	6	Nov. 27, „	Trinidad.
Golden Fleece ...	524	Sept. 2, „	—	—	6	6	Nov. 30, „	Demerara.
Sir Henry Lawrence.	462	Sept. 16, „	1	5	6	12	Dec. 15, „	„
Hereford	588	Sept. 20, „	—	—	3	3	Dec. 9, „	„
Loch Lomond ...	518	Jan. 27, 1874	—	11	—	11	Apr. 21, 1874	Jamaica.
Rohilla	425	Feb. 17, „	4	—	—	4	May 11, „	Demerara.
Blenheim (steamer).	692	June 13, „	—	—	5	5	July 8, „	Natal.
Golden Fleece ...	519	Aug. 6, „	—	—	2	2	Oct. 29, „	Trinidad.
Forfarshire	509	Aug. 18, „	—	13	1	14	Nov. 5, „	Demerara.
Lincelles	342	Oct. 7, „	—	7	—	7	Jan. 8, 1875	St. Vincent.
British Empire	633	Nov. 8, „	—	—	2	2	Feb. 25, „	Trinidad.
Lady Melville ...	391	June 12, 1875	—	—	1	1	July 24, 1875	Mauritius.
Atalanta	393	Mar. 22, 1876	1	—	—	1	May 13, 1876	Natal.
Linguist	600	Aug. 2, „	—	1	—	1	Oct. 20, „	Demerara.
Artist	552	Sept. 30, 1877	2	6	—	8	Dec. 29, 1877	„
Boyne	568	Feb. 13, 1878	—	7	6	13	May 15, 1878	„
Glenroy	486	May 18, „	1	—	—	1	July 17, „	Natal.
Ophir	351	June 19, „	—	4	—	4	Aug. 22, „	„
None	—	1879 and 1880	—	—	—	—	—	—

years following, there were only seven attacked, and in the next two, 1879 and 1880, there were none. From 1871 to 1874 six ships showed cholera in the first period, two of these had no death subsequently; two others, which had had one death early in the first period, had one, and three, respectively, in the second, and no more; and the other had deaths in all three periods. Of the remainder, twelve had their first death in the second period, of which five had others in the third; and there were seven attacked in the third period. From 1875 there were three ships in which cholera appeared in the first period, and in one of them again in the second; and in three others in the second period, and in one of them again in the third period; there was but one instance, the *Lady Melville*, in which the first death occurred in this.

The positions of the different ships named in the Table may be made out, approximately, to the twentieth day, from the remarks already given, but, as their longitudes are not mentioned, there will be more uncertainty after this, though they will not deviate materially from the track of those on the accompanying map. The mean duration of the voyages of the sailing vessels, from Calcutta to Mauritius, was forty days, and to Natal sixty days. I have records of two ships—the *Gertrude*, which left Calcutta in May 1859 with military invalids, which had eight attacks of cholera, the first on the seventeenth day out, in 2 deg. N., 89 deg. E., and the last on the thirty-fourth day out in 24 deg. S., 58 deg. E., just south of Mauritius; and the *Alnwick Castle*, in November 1861, with coolies, one of whom was attacked with cholera on the thirtieth day out, in 23 deg. S., 57 deg. E., also south of Mauritius. The steamer *Blenheim* landed her coolies at Natal on the twenty-fifth day after embarkation; being a full-powered vessel, she would make a straight course for Ceylon and Mauritius, and from that to Natal. As the distance from the Hooghly to Mauritius, by this track, is 3,180 miles, and from there to Natal 1,500, assuming the ship to have made equal progress daily (and it would not have differed materially from this), she would have been off Mauritius in seventeen days, so that the outbreak commenced after she had passed that island. The *Enmore*, another steamer, which landed her emigrants at Demerara on the fifty-second day after embarkation, would have pursued the same course; she must have been south of Mauritius about the seventeenth day after sailing. At Mauritius itself there were a considerable number of

sporadic cases at the end of 1870, and in the course of 1871, and early that year, cholera became epidemic at the Seychelles Islands, 900 miles north of Mauritius, and along the east coast of Madagascar; but I have no record of it having been met with between 1871 and 1880, either at Natal or in the Cape Colony. On the other hand, it is to be remarked that, from 1868 to 1871, an epidemic of cholera, which was first heard of in latitude 5 deg. N. and longitude 38 deg. E., in the former year, passed southwards, reaching Zanzibar at the end of December 1869, and Quillimane at the mouth of the Zambesi in 1871. This was met with to the west of Lake Tanganyika and Lake Moero, upwards of 700 miles from the coast, and under it there were outbreaks in Johanna and Mayotta, two of the Comoro Islands, and at Majunga on the west coast of Madagascar, and at Nossi Be, a small island north of that place.

While the changes in the distribution of cholera, detailed above, were in progress, a very striking reduction in its incidence in British India was also taking place, as will be obvious from the numbers in Table II of the deaths registered in the various provinces during the years 1869

TABLE II.

Districts.	1869.	1870.	1871.	1872.	1873.	1874.
Punjaub... ..	9,258	469	169	8,727	148	78
N.W. Provinces and Oude.	92,676	45,451	19,505	77,131	19,229	6,464
Bengal	—	6,511	20,396	46,901	64,366	56,876
Central Provinces and Berar.	135,728	59,517	24,111	32,059	1,467	366
Bombay Presidency						
Madras Presidency						
British Burmah ...	1,025	250	162	640	8,109	960
Ceylon	5	301	61	{ Not known }	14	11

Districts.	1875.	1876.	1877.	1878.	1879.	1880.
Punjaub... ..	6,246	5,736	29	215	26,135	274
N.W. Provinces and Oude.	64,427	48,311	31,770	22,221	35,892	71,546
Bengal	112,276	196,590	155,305	95,192	136,363	39,643
Central Provinces and Berar.	179,410	203,113	418,918	169,201	48,031	1,628
Bombay Presidency						
Madras Presidency						
British Burmah ...	761	3,678	7,276	6,759	1,828	2,638
Ceylon	1,817	Not known.		Not known.		799

to 1880 inclusive. The registration for Bengal was so defective in 1869 that the results were not published; that for 1870 in the Table is for the last six months of the year, and that for 1871 is evidently too low.

The numbers in this Table show a great reduction from 1869 to 1871 (Bengal excepted). In 1872 there was an increase in all the Provinces, very considerable in Bengal and that to the north of it, but to a much smaller amount in those to the south. In 1873 there was again a marked diminution in the number of deaths in all the Provinces except Bengal and Burmah; the reduction in the North-West Provinces was to one-fourth of those in 1872, and in the Central Provinces, Berar, and the Bombay and Madras Presidencies, to a twenty-third of the deaths in 1872; in 1874 there was a still further decrease, reducing the numbers in the North-West Provinces to one-twelfth of their amount in 1872; and in the Central Provinces, Berar, and Bombay and Madras Presidencies, to one eighty-eighth. In the latter year, indeed, cholera had almost disappeared from these extensive areas. In 1875 there was an enormous increase of the mortality of cholera all over Hindostan, from Cape Comorin to Lahore.

While these occurrences were in progress, cholera was extremely prevalent in the countries to the eastward of the Bay of Bengal and Indian Ocean. Cornish, in his *Sanitary Report for Madras*, for 1873, states, at p. 91: "While the Peninsula of India has on this occasion escaped invasion, it must not be forgotten that cholera has been noticed in great force in the territories to the east of the Bay of Bengal. In Burmah, Tenasserim Provinces, Cochin China, the Straits Settlements, and the Islands of the Indian Archipelago, the destroyer has reaped a goodly harvest of victims."

The deaths from cholera in the Burmese territory, in the Table, show there were considerable fluctuations in different years, varying from 162 in 1871, to 8,109 in 1873; declining again to 761 in 1875. The Lisbon authorities declared the Island of Timor affected as early as February 1872. British Burmah, consists of a narrow slip of territory running southward along the eastern side of the Bay of Bengal from Chittagong to Cape Negrais, in lat. 16 deg. N. (which is separated from the Valley of the Irrawaddy by a high range of mountains), together with the valleys of the Irrawaddy and Saltang River to lat. 19 deg. N., and a narrow portion along the western shore of the Peninsula as far as 10 deg. N. The behaviour of cholera in these two

divisions differs materially, both as to time of appearance and to severity, as will be obvious from the following, in which the deaths in the above Table, for the whole district, have been distributed to the sub-divisions in which they occurred.

Years.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.	1880.
In Northern Sub-division.	560	11	80	212	1308	2357	1518	444	126
In Southern Sub-division.	80	8098	880	548	1424	4919	5241	1384	2512

These figures show that the northern sub-division, so far as cholera is concerned, is epidemiologically connected with Bengal, while the southern sub-division is more intimately connected with Siam, Cochin China, and the Archipelago to the south and east of it. There is no clear account of the commencement and increase of the epidemic in this extensive area, but the announcement of the Portuguese Board of Health, that cholera was at Timor in 1872, and Mr. Cornish's description of it in 1873, with the deaths in Burmah in 1873 and 1874, leave but little doubt on its general features and progress.

It has been shown above that sailing-ships from Calcutta, on the sixth day after leaving the land, will have reached 15 deg. N. on the 90th meridian; and by the twentieth day will have got to about 1 deg. N., near the same meridian. From the sixth day out, therefore, they will be to the south of Cape Negrais, and any emanations carried to the south-westward from the Valley of the Irrawaddy, and the cholera districts to the east and south of it, will pass directly over their track in the second period in the Table given above, viz., from the sixth to the twentieth days at sea; after the twentieth day, when they have got into the third period, they will still be exposed to the same influence; but as there are no longitudes given for the sailing-vessels in the Table, the extent to which it is operative in these instances cannot be indicated, but others will be noticed hereafter in which the disease occurred as far as Mauritius, and even beyond it. The *Blenheim*, however, a steamer referred to above, from Calcutta to Natal in 1874, was on the fourth day out in lat. 10 deg. N., long. 83 deg. E.; on tenth day 4 deg. S., 73 deg. E.; and on seventeenth day 20 deg. S., 57 deg. E., close to Mauritius. There was no death from cholera in the *Blenheim* until she passed Mauritius. The

Enmore, also a steamer, for Demerara in 1873, which would have passed over the same course, and at much the same rate as the *Blenheim*, had two deaths by the fourth day out, one on the tenth, one on the seventeenth, and one on the nineteenth, besides five after the twentieth, must have had the case on the seventeenth while she was off Mauritius, and the other six after passing that island.

This great reduction in the activity of cholera at sea, in 1875, was followed by its return in force over those portions of Hindostan from which it had almost disappeared in 1873 and 1874, and the steps by which its return was indicated are worthy of examination. For many years now the general belief has been that the cause of cholera becomes active in the endemic area in Lower Bengal, and spreads from that locality not only over Hindostan, but beyond its boundaries into other countries; in conformity with this idea it was concluded that Ceylon always received its epidemic of the disease from the adjacent part of the Madras coast; different epidemiologists attributing the diffusion, some to aerial currents, others to communication from man to man, while pursuing their ordinary avocations.

Taking the deaths from cholera in the first four months of 1875, for the Provinces already referred to, they stand as follows:

TABLE III.

Districts.	January.	February.	March.	April.
Punjaub	4	4	4	10
N.W. Provinces and Oude	35	216	1,923	14,757
Bengal	5,530	5,941	11,821	12,954
Central Provinces and Berar	9	24	109	956
Bombay Presidency				
Madras Presidency				
British Burmah	1	—	8	25
Ceylon	16	70	281	102

Here Bengal, with a population of sixty millions under registration, shows an active epidemic in progress from January onwards; the North-West Provinces and Oudh, with fifty-six millions under observation, present an increase from January, at first slight, but more marked in March and April, though this was almost confined, at this time, to that portion of them lying between Bengal and Oudh. In the Central Provinces, Berar, the Madras and

Bombay Presidencies, with a population of fifty-six millions, occupying most of the area from Bengal southwards to Cape Comorin, the deaths from cholera to March, inclusive, were 142 only, while in Ceylon, where the population was only about two-and-a-half millions, 367 died from this disease, showing a much greater activity of its causes in Ceylon at that time than any part of Hindostan to the south of Bengal. Since the registration of deaths was introduced in India, it has been found that, in addition to the endemic area in Lower Bengal, there are other localities where, for years in succession, a month seldom passes without one or more sporadic cases, and, in 1875, as the season advanced, it was in these localities where the earliest cases occurred; and the disease radiated from them, gradually occupying the intervening country. There are two such localities on the east coast of the Madras Presidency, to the south of Madras, South Accot, and Tanjore, the latter being the delta of the Cauvery, in about 11 deg. latitude N.; the deaths from cholera in these, and in Trichinopoly, which lies between them, in the first four months in 1875, were as follows:—

			January.	February.	March.	April.
South Accot	...	...	3	6	—	3
Trichinopoly	...	...	—	—	1	—
Tanjore	...	...	4	7	2	65

Amounting to ninety-one in a population of close on five millions, while in Ceylon, during the same period, there were 469 among a population of half the number. The epidemic seems to have commenced in Colombo and its neighbourhood early in January, and to the end of April was confined to the southern half of the west coast, from Negombo to Galle, Negombo being 240 miles from the nearest point of the Tanjore territory in Madras. It is obvious, therefore, that Ceylon must have been subjected to the action of the cholerific factors quite as early as the Tanjore locality, and in a more concentrated form, and as the places first affected in Ceylon were in the southern part of the West Coast, instead of the northern part, the weight of the evidence is altogether opposed to the conclusion that they were carried by man.

In Table I the *Lady Melville* is shown to have had one death, after the twentieth day at sea, in 1875; and, in 1876, the others had single deaths, viz., the *Atalanta*, on

the third day after embarkation, and hence referable to the shore, as being within the incubation period; the other in the *Linguist*, on the sixteenth day after embarkation. In 1877 and 1878 four ships were attacked, which presented twenty-six deaths from cholera, distributed over the three periods in the Table; of these, the *Glenroy* had a single death on the third day after embarkation; the *Artist* had two by the fifth day, and six more by the twentieth; the *Ophir* had four from the fourteenth to the nineteenth; and lastly, the *Boyne* had seven from the tenth to the twentieth day after embarkation, and six more after the twentieth. In Bengal cholera had been prevalent from 1876 to 1879, but in 1880 there was a large reduction. In the North-West Provinces and Oudh the deaths had fallen from 64,427 in 1875 to 22,221 in 1878, from which they then increased to 71,546 in 1880. In the Central Provinces, Berar, and the Madras and Bombay Presidencies, in 1877, owing to the severe epidemic of cholera, combined with the famine in the Madras Presidency, the deaths rose to 418,918, from which they fell, by large reductions, to 1,628 only in 1880. The deaths from cholera in Burmah, in 1877, were almost ten times more numerous than in 1875, and continued nearly as frequent in 1878; in both years far the greater portion of them were in the southern division of that country, as had been the case in 1873 and 1874. I have very little information about the prevalence of the disease in the countries to the east of Burmah in 1877 and 1878, but the French transport *Corrèze*, which left Saigon in July of the former year, with 500 troops and other passengers, for Europe, was attacked a few days after sailing, for which she was afterwards sent to Gebel-el-Tor, near Suez, under observation, though ultimately permitted to pass through the canal in quarantine. The occurrence of these few cases of cholera, with a marked increase of its frequency in the southern division of the Burmese territory, notwithstanding the enormous difference in the incidence of the disease over the southern portion of the Indian Peninsula, merits attention.

If, now, the circumstances under which epidemics of cholera reached Mauritius formerly be examined, it will be found that unusual frequency of the disease along the southern portion of the eastern coast of the Bay of Bengal and among the territories and islands to the eastward had preceded that extension. In 1819 cholera was epidemic in Ceylon, also along the southern portion of the Burmese

territory already referred to, along the peninsula of Malacca, including the town so named, at Bangkok in the kingdom of Siam, at Acheen in Sumatra, and at Java. The *Topaze* frigate arrived at Trincomalee, in Ceylon, on 5th September, with a large sick-list, mostly dysentery. At Trincomalee one man died of cholera on 16th September, two others on 20th, and there seem to have been several recoveries. She sailed for Mauritius on 9th October, and soon after cholera broke out again, and there were seventeen attacks, of which four proved fatal on board. The *Topaze* arrived at Mauritius on 19th October. Thirty-six men were sent on shore to the military hospital, where six of them died, five from the sequelæ of cholera. No case of cholera occurred on the *Topaze* after her arrival at Mauritius, but in three weeks it commenced among the population. It is to be observed here, as having a most important bearing on the question of the introduction of cholera to Mauritius on this occasion, that a Board, assembled by Major-General Darling, the Governor, on 23rd November 1819, to investigate the point, stated, in their report, "that the first well-marked case of the present disease occurred on the 6th September last, and was treated by Mr. Trebuchet in Port Louis" (the *Topaze* did not reach the island until the 29th of October); "it differed nothing from the cases which have presented themselves since the 18th and 19th instants."* The troops at Mauritius had a ratio of 103 attacked and 16.6 deaths per 1,000 from cholera in 1819, and of 132 per 1,000 attacked, with 9.8 deaths in 1820. At Cape Town there was a ratio of 1.7 attacks per 1,000 in 1819, and of 4.1 attacks in 1820, without any death. The disease also prevailed on the east coast of Madagascar, and slightly in the Island of Bourbon.

The next well-marked epidemic of cholera in Mauritius occurred in 1854. Cholera had been prevalent, in 1853, in Rangoon and the country to the south of it, as also in Sarawak and Borneo; but I have no record of its frequency in the intermediate countries. In 1854 the *Sultany* sailed from Calcutta for Mauritius on February 10th, with a crew of 80 men and 375 emigrants; on 28th February, when she had been a fortnight at sea, cholera broke out. She arrived at Mauritius on 25th March, thirty of the passengers having died of cholera during the voyage; some more occurred during her stay in the roadstead of Port Louis before the emigrants were landed at the lazaret.

* *A Treatise on Asiatic Cholera*, by C. Macnamara, London, 1870, p. 41.

There they continued healthy until they were liberated, on 1st May. The crew of the vessel had remained healthy all the time. A Board of seven members, five of whom were experienced resident physicians, appointed by the Governor to examine into the history of the epidemic, reported, among other matters, that the earliest cases in Port Louis occurred on 14th May, among the inmates of the prison, which at the time was much crowded and badly drained. They also reported that five cases of cholera had occurred in the town between the beginning of the year and the arrival of the *Sultany*. As showing that the epidemic influence was active about this time far to the south-west of Mauritius, it is worthy of notice that about April 1853 an hospital-attendant of the 43rd Regiment, at King William's Town, in the Cape Colony, had a well-marked attack of cholera.

In 1856 there was a fresh visitation of cholera, commencing in March, and continuing till the middle of May; the deaths in the colony from it amounting to 3,303. A Special Committee of the Legislative Council (among whom was no medical man) was appointed by the Governor to inquire and report on the cause of this outbreak, and whether it was expedient to make any change in the quarantine laws then in force. Notwithstanding the general doubts expressed by the leading medical men of the colony, the Committee, with one dissentient, did not hesitate to ascribe the epidemic directly to importation by a steamer at the quarantine-station, on board which one of the crew had sickened, although no communication could be traced between this man and the earliest attack in Port Louis, and none of the officials or police of the lazaret were affected. The result was, that still more stringent quarantine regulations were adopted in the next session of the Legislature.

In 1857, and still more 1858, cholera became active at Singapore, Hong Kong, in the Philippine Islands, and along the coast of China. The *Gertrude* left Calcutta on 21st May 1859, with 120 military invalids on board, and some other passengers and her crew, for England, and on 27th got to sea; some cases of dysentery and diarrhoea seem to have occurred after sailing. Cholera appeared on June 12th, in about 2 deg. N. and 89 deg. E.; and dropping cases occurred, the last on 29th June, about 24½ deg. S. and 58 deg. E.; altogether there were nine cases of cholera, of which eight proved fatal.

The *Alnwick Castle* from Calcutta, with coolies, had a

single case of cholera on 27th November 1861, in 23 deg. S., 57 deg. E., just south of Mauritius. She had been thirty days at sea, having had no communication with land or any other vessel.

The military returns show slight indications of cholera among the troops in Mauritius in 1859 and 1860, and it appeared in an epidemic form among the civil population on two sugar-estates, on the elevated ground of Plaines Wilhelms, between six and seven miles from Port Louis, in September; the cause was not detected. After a lull from the 25th November to 13th December it reappeared, and ceased at the end of 1860. In December 1861 cholera became epidemic again in Mauritius, and continued till the middle of 1862, and it is said caused upwards of 4,000 deaths. There were traces of ordinary cholera at Cape Town in 1859; and in January or February 1861 a case of malignant cholera, which passed into collapse, but recovered, and much choleraic diarrhoea at Maritzburg in Natal.

In 1863 and 1864 there was again much cholera met with in Burmah, Singapore, Java, in the Philippine Islands, and at Hong Kong, and it was still active in the last-named in 1866. A ship, the *Queen of the North*, left Bombay for England on 22nd January 1864, with a crew of twenty-seven, and 272 passengers consisting of officers, time-expired men, some invalids, women and children. Several of the invalids and women and children had suffered from bowel-complaint previous to embarkation. One woman, whilst under treatment for diarrhoea, was attacked on the evening of the 24th with vomiting and purging, with a disposition to collapse, and died the following evening; but the medical officer hesitated to call the case cholera. Two other cases with collapse, but without cramps, and with bilious stools, occurred on the 28th and 29th January; both recovered. The first unequivocal case of cholera appeared on 1st February, and proved fatal the same day; the ship's position on this day was 2 deg. 49 min. N., 77 deg. 7 min. E, with a fine north-easterly breeze. From this to the 7th there were slight breezes and calms, and a heavy thunderstorm on the latter, and three cases of cholera occurred. Slight winds and calms prevailed until the evening of the 13th, when the S.E. trade wind commenced about 10 deg. S., and by the 15th the ship's position was 14 deg. 3 min. S., 77 deg. 18 min. E. From the 8th to the 15th, inclusive, there were thirty-seven attacks of malignant

cholera, of which twenty-four proved fatal. There was no attack after the 15th, and the last death was on the 19th. The provisions were good, but the water, which had been obtained at Bombay, always became opaline after exposure to the air for a little. Diarrhœa was very common, among both passengers and crew, from about 5th February; the crew who were berthed in the fore-castle, which had no communication with the hold, had no cholera; but the chief officer, who messed in the cabin, and drank large quantities of water, was attacked and died. The cases of either disease did not come from any particular part of the troop-deck, but were spread all over it. It will be seen by the ship's positions, when the violent outbreak commenced on the 8th February, that, though coming from Bombay, she was then not far from the common track of sailing-vessels from Calcutta after they crossed the line. That the water had something to do with the sudden outbreak of cholera seems highly probable, but its abrupt termination, notwithstanding the same water continued to be employed, would indicate that there was something connected with the locality, for the time being, of the greatest importance in its production. Another ship, the *Durham*, embarked, on the 24th February 1866, thirteen officers, 422 non-commissioned officers and men, and forty women and children, for England, and seems to have sailed the following day. Ten cases of cholera occurred during the voyage, the first on the 9th March, when she was in 10 deg. 15 min. N., the next on 19th March, when she was just south of the line, and the remainder onwards, the last on the 1st April, when she was 20 deg. 0 min. S., and 72 deg. 10 min. E. There were five deaths in all from cholera. The *Durham* at this time was close to the position of the *Queen of the North* on the 15th February 1864, though, fortunately for the passengers, her experience was so different. In September 1865 there were several coolie ships in quarantine for cholera at Mauritius, and sporadic cases on shore. At Cape Town, in February 1865, there were many cases of severe cholera; and at Port Elizabeth, one case of severe common cholera in end of October 1865; and on 12th November, at sea, in 33 deg. S., 37 deg. E., one case, a soldier of the 96th Regiment, on board the *Renown*, which had been in quarantine since her arrival from Gibraltar on 9th October, and had been thoroughly disinfected before the 96th embarked on 9th November at Port Elizabeth. In October 1866 a lady in Cape Town, who had not been out of the colony, died of

malignant cholera. At Maritzburg, in Natal, choleric, diarrhœa with severe cramps in abdomen and limbs, with tendency to collapse, were frequent in end of December. The *Alumbagh*, from Mauritius to Port Elizabeth, had a single case of common cholera about 1st March, when midway between these two places. The *Windsor Castle*, with troops on board for Kurrachee (mentioned farther on), which had been affected with cholera on her passage from England in 1866, and had the last seizure in the Atlantic, in a soldier's wife, on 20th August, which terminated fatally on September 3rd, in 34 deg. S., 8 deg. E., from secondary fever, had a seaman attacked on September 15th (after she had passed the Cape), in 37 deg. S., 32 deg. E., who died in a few hours.

The above details place it beyond doubt that ships traversing the Indian Ocean pass through localities in which their passengers suffer from cholera many days after they have left the land and its immediate influences; and as, in most instances, there has been no succession of cases to keep up the disease from the date of sailing, its occurrence must be attributed to factors they encountered in the localities where they suffered. These factors occupy fresh localities from time to time, as they do on land; and when that from Mauritius to the east coast of Africa is involved, as shown by the appearance of cholera on shore, ships passing in the vicinity of these points have had one or more cases, though they had been many days at sea, and without any recent or even any previous case, the essential factors must then be altogether independent of the shore or of previous cases, and, in fact, can only be those designated epidemic or pandemic causes.

A few remarks here on epidemics of cholera which have prevailed on the south-east coast of Africa, with their modes of invasion, will prove useful in elucidating this question, and placing its relations to those traced above in a clearer light than it stands at present. We are chiefly indebted to Dr. Christie, who was physician to the Sultan of Zanzibar (now of Glasgow), who, in his work on *Cholera Epidemics in East Africa*, published in 1876, detailed the various epidemics which had shown themselves at Zanzibar and its neighbourhood, and described the caravan-routes from the coast to the interior followed by the native traders in the pursuit of their ordinary traffic. Dr. Christie mentions the epidemics of 1821, 1835, 1858-9, 1865, and of 1869-70. Of the first, that of 1821, no satisfactory information could be obtained at Zanzibar; that of 1835 seems

to have been an extension south-west of an outbreak in southern Abyssinia in 1834, mentioned by Dr. Kirk; it reached Zanzibar about November 1835, and passed on to the southward, but how far is not known. The epidemic of 1858-9 was thought by Dr. Christie to be an extension of that which was in Abyssinia in 1856. The next invasion is supposed to have started from Berbera. Dr. Christie remarks it as first heard of at Merka, a port 2 deg. N., in a severe form, but it broke out at Lamoo, 2 deg. S., and reached Zanzibar at the end of November. It subsequently proceeded south as far as Cape Delgado, causing great mortality. It does not appear to have gone far inland. The epidemic of 1865 passed from Berbera, opposite Aden, south along the caravan-route as far as Gannah and Barderah, on the river Jub, and thence to the coast; it reached Melinda in June, and was experienced a little further south at Mombassa, where the south-west monsoon set in strongly, by which its southerly progress was stopped and its course turned in the opposite direction, and more over the land. The epidemic did not reach Zanzibar. The last outbreak was in 1869-70. Dr. Christie attributes the origin of this to that of 1866, in Abyssinia; it was first heard of by the native traders as being in a locality about 5 deg. N. and 37 deg. E., about the end of 1868. If from Abyssinia, it must have been dormant for some time, as the interval is very large for the space it would have covered had it been in motion. This epidemic, in the first nine months of 1869, gradually overspread the country from 1 deg. N. to nearly 6 deg. S., between the meridians 34 deg. and 39 deg. E. It reached the coast-town Pangani in October, and Zanzibar a few days later, and subsequently affected the Portuguese settlements at Mozambique, and, in 1871, extended to Quillimane, and, inland, prevailed on the west side of Lake Tanganyika.

Proceeding now to the Atlantic, though there are many instances in which ships carrying emigrants from Europe to America have suffered severely from cholera, still the records of most are so deficient in details, necessary to admit of a satisfactory analysis being made of the various factors which have contributed to that result, that they are of little use in this inquiry. Of those which are available for the investigation, the instances of the *Swanton* and *New York*, ships which carried 280 and 338 emigrants from Havre, in the end of 1848, to New Orleans and New York, respectively, are most valuable. The emigrants were Germans, and had passed about two months at Havre

in a wretched condition, while waiting for embarkation; there was no cholera at Havre during their stay, but one report stated some few had arrived, from infected places in Germany, in time to embark with the others. The *Swanton* sailed on 31st October 1848, and the *New York* on 9th November. On the 23rd and 24th the *New York* had a very cold wind from the north-west, followed by a very warm one from south-east on 25th, and on this day, in lat. 42 deg. N., long. 61 deg. W., the first case of cholera occurred. The *Swanton* had no cold wind on 24th, but on the 25th, as with the other, the wind became south-east, and was described by the captain as unlike any he ever experienced before, and was more like artificially heated air than anything else. The first case of cholera appeared in the *Swanton* the following day, the 26th November, when in lat. 26 deg. N., long. 57 deg. W., she being then about 1,000 miles south of the *New York*. On the 24th there was a general opening of trunks by the emigrants in the *New York*, to obtain warmer clothing; but in the *Swanton*, as there had been no cold weather, this was unnecessary, and the baggage was undisturbed; yet the writer describing these occurrences in the *Cholera Epidemic of 1873 in the United States*, at page 608, gives the following quotation regarding them: "It seems to me far more probable that the poison was lurking in the luggage of the passengers, and that the emergencies which required the opening of the unventilated trunks and packages let loose in each of these ships that poison brought from the infected regions of Germany." The remark of the captain of the *Swanton*, that it was more like artificially heated air than anything else, affords a clue to the mystery that now enables it to be explained. Anyone who has experienced a hot wind, with which many of you no doubt are familiar, will see at once this is what he described, but, as a hot wind always originates over arid land, how could such a wind have been experienced from the south-east at the place where the *Swanton* was, from which a south-easterly line would pass through the South Atlantic clear of all land? The wind was really from the desert in North Africa. In November, when the north-east trade is being re-established over the Northern Atlantic, it reaches to 6 deg. N.; and about long. 30 deg. W., and lat. 10 deg. to 20 deg. N., at this season, north-easterly winds are frequently experienced such as are described by the captain of the *Swanton*, and, in addition, often bearing red dust in such quantity as to cover the sails and rigging of passing

vessels, leaving no doubt as to their place of origin, and further illustrating their transporting powers. Such a current of air, which did not come to the surface of the sea, but continued to flow at some elevation above it, would retain its peculiarities for a long time; it would pass on to the inner limit of the trade, about 6 deg. N. in November, and then rising in the atmosphere, as the air of the trade does, would double back to the north-west, constituting a south-east wind when it fell to the earth's surface, as the *Swanton* experienced it. In November 1848, when these occurrences took place, there had been cholera in Egypt and along the north coast of Africa, and, with a moderate velocity of twenty miles an hour, the wind could have transported emanations from that to the *Swanton* in from ten to twelve days.

The *New York* reached her destination on 1st December, having lost seven of her passengers and sent eleven to hospital, which number was increased to twenty the following day. Up to 28th December about 100 cases had occurred in quarantine, fifty of them fatal; and only two in the city. Though upwards of 100 of the passengers by the *New York* had absconded from the lazaret into New York, no more cases presented themselves in it until 11th May. The *Swanton* reached New Orleans on 11th December, having lost thirteen passengers from cholera. She went at once to her wharf, and proceeded to land her passengers and cargo. She sent one emigrant to hospital with cholera on arrival, and another the following day.* So rapid was the spread of the disease that, on the 16th December, it had diffused itself over a large portion of the city, and attacked those who could not, by any possibility, have had any communication with the ship or with each other. Dr. Fenner had attended, as early as 5th December, a gentleman who had symptoms of cholera so well marked that he should have pronounced it, but for the absence of the epidemic, a case of that disease. Cases of a similar

* It is but proper to notice here that Dr. Fenner mentioned subsequently; that, on December 6th, 1848, the ship *Gutenberg* arrived at New Orleans from Hamburg, with 250 German emigrants, after a passage of 55 days, during which six or seven deaths had occurred from cholera; one of the early cases at New Orleans was a man from this vessel. The barque *Callao* arrived from Bremen on December 8th, with 152 German emigrants, after a passage of 48 days, during which she had lost eighteen from cholera. The *Callao* was kept at Slaughterhouse Point, opposite to New Orleans, until January 4th, when she was brought over to the city and unloaded. (*Cholera Epidemic of 1873 in United States*, p. 610.)

kind occurred in the practice of physicians in different parts of the city, showing *that the epidemic influence of cholera was gradually being matured and developed*.*

The following description, of the suffering of a body of United States troops, has an important connection with the first manifestation of cholera at New Orleans in 1848. The 8th Infantry, U.S.A., left Jefferson Barracks, near St. Louis on the Mississippi, on 24th November; they reached New Orleans on 1st December, and were landed at Jackson Barracks, three miles and a half below the city, and accommodated in sheds till the 12th, when they embarked in steamers for Lavaca, in Texas, and arrived there on the 14th. The disembarkation was not completed till the 19th December, when they were encamped on a brackish bayou or creek. On the 21st a wing was advanced about twelve miles, to a more favourable locality; that night a violent cold northerly wind came on, and "cholera showed itself in both camps, and, by the morning of the 22nd, had attacked more than one-eighth of both commands. The disease continued with great violence during the 22nd, 23rd, 24th, and 25th, when it began to abate; by the 30th it had entirely subsided." There were 133 deaths out of 196 cases (*Sickness and Mortality in the Army of the United States, Washington, p. 398*). These troops could not have been affected by the sick either from the *Gutenberg* or *Swanton*, yet the extension of the epidemic influence, and the depressing effects of the cold wind, and possibly to some extent the brackish water, caused a frightful mortality amongst them.

Another ship, the *Apollo*, which embarked the 59th Regiment (amounting, with women and children, to 693 persons) at Cork, for China, a few months after the *Swanton* and *New York*, suffered from cholera in her passage southwards, and affords an additional proof that a choleric influence was, about that time, in operation extensively over the Atlantic. This ship was frigate-built, that is, with a gun-deck completely covered, but with the usual side-ports, and a lower deck called the orlop, with small side-scuttles only; the crew and part of the troops occupied the gun-deck, and the remainder of the troops, with the females and children, were accommodated on the orlop, the ventilation of which was naturally much inferior to that of the gun-deck. The troops embarked on the 12th June 1859,

* *Report of General Board of Health on the Epidemic Cholera of 1848 and 1849, Appendix C, being Abstract of Report on Epidemic Cholera as it prevailed in the United States in 1849 and 1850, p. 79.*

and the ship sailed on the 17th. Cholera had prevailed at Cork for some time, but there had been none in the barracks which the regiment had occupied before going on board, nor in the ship herself. On the morning of the 18th, a soldier, who had had diarrhoea for some days, got out of his hammock, much heated, and, placing himself under the tap, allowed the water to run over his body. Collapse ensued immediately; there were slight cramps, with the characteristic evacuations, and he died in seven hours. No other case occurred till 27th June, when a man was attacked in 35 deg. 21 min. N. and 15 deg. 25 min. W.; and up to July 1st, when the ship reached Teneriffe, another man, a woman, and two children had been attacked, all of whom died. From 2nd July to 15th, five men and a woman were attacked, all of whom recovered. On the 16th another man was attacked, who died. On the 17th, in 5 deg. 14 min. N., 24 deg. 3 min. W., there was heavy rain; and from the 18th to the 23rd there were fifteen men attacked, eight of them being part of the crew; seven of the fifteen died. The south-east trade commenced on the 24th, in 0 deg. 26 min. S., and subsequently to the 12th August seven other cases occurred among the troops, of which six proved fatal. The ship was now off Rio Janeiro, but, being refused pratique, proceeded to the Ilha Grande, sixty miles to the westward, where the troops and crew were landed, all her stores removed, and she was thoroughly disinfected. After this the crew and troops were re-embarked, and she completed her voyage to Hong Kong without any further trace of cholera. There had been much choleraic diarrhoea during the passage to Brazil, many of the cases so severe that the medical officer, Dr. Thomas Fraser (now Deputy Inspector-General on the retired list), was frequently in doubt whether they should not be classed as cholera, in addition to those so returned above.

To show that the outbreaks of cholera at New Orleans, and northern coast of the Gulf of Mexico, were not the only epidemics connected with the influence the *Swanton* and *Apollo* encountered in the middle of the Atlantic, it is to be noted that cholera appeared sporadically on the coast of New Granada, in South America, in June 1849, and became epidemic in the towns along the coast in July and August, and ascended the valley of the Magdalena to Bogota, about 500 miles inland and 8,000 feet above the sea. In Jamaica, at this time also, there were several sporadic cases of the malignant form, viz., a soldier of the 2nd West India Regiment, at Port Royal, in August, and,

in Kingston Barracks, some soldiers, as well as several civilians in the town, were affected about the same time. There was also a European soldier, quartered at the mountain-station Newcastle, who was attacked in October. The disease was much reduced in frequency on the coast of New Granada towards the end of 1849; but in the spring of 1850 it became active again, and extended westward. It became epidemic in Jamaica also, commencing on 7th October, and proved very destructive in that island. In 1850 there were four European soldiers attacked with cholera in Barbadoes from July to September, and one in St. Vincent, of whom three died; and ten more from October to December, at the former of which one died. Two white soldiers were also affected with cholera in Dominica in the last quarter of the year. There were also several cases of common cholera among the civil population at most of the Windward and Leeward Islands in 1850, a few of them proving fatal.

Hirsch gives the following case, in which the ship passed over nearly the same course as the *Apollo*, and presented incidents closely corresponding with those which that ship underwent:—

“On the 13th October 1855, the emigrant ship *Franziska* sailed from Hamburg for Rio Janeiro, with 220 'tween deck passengers, thirteen officers and cabin passengers, and sixteen of crew. On the 23rd of October, or ten days from the sailing of the ship, a case of cholera, ending fatally, occurred in a man twenty-seven years old; a second case followed on the 8th of November, the ship being then in the latitude of Madeira; and now there developed an epidemic which lasted until the ship arrived in the harbour of Rio, on the 12th December, or over a period of nearly six weeks, although there were only sixteen deaths. Among the cabin passengers, officers, and crew not a single case of sickness occurred.” (*Geographical and Historical Pathology*, vol. i, p. 486.) There was much cholera along the south coast of the Mediterranean from Egypt to Morocco in 1854-55; Madeira was affected in 1855; and Fogo, one of the Cape de Verde Islands, became affected in the beginning of July. A Sardinian vessel from Savona, with emigrants for Buenos Ayres, among whom there had been considerable sickness, arrived at Fogo on 30th June; the nature of their complaints seems not to have been inquired for, and the vessel was admitted to pratique and her passengers landed, and the vessel cleaned and disinfected. On 4th July five persons were attacked with cholera, and the

following day the deaths were so numerous that the authorities and principal people fled in terror to the next island, St. Jago. The population of Fogo at this time was 5,195, and the deaths from cholera were 123. In 1856, St. Vincent, another of the Cape de Verde group, became affected with cholera on 23rd August, which lasted twenty-eight days, during which period the deaths were 626 out of a population of 1,350. Consul Miller, who was there during the whole epidemic, was of opinion the epidemic was generated on the island, as the vessels from infected ports had brought no cases of sickness with them. (*Abstract of Information on Laws of Quarantine*, published by Board of Trade, Parliamentary Papers, 18th August 1860, p. 13.)

Cholera was prevalent in New Granada in 1854, and in Venezuela in 1855, but up to this year it had not appeared in Brazil; now, however, it broke out at Para in the middle of May, at Villa Imperatriz and Province of Amazona in the beginning of June, and at Bahia in the end of June. Shortly afterwards Rio Janeiro was affected, and the whole coast of Brazil from Rio Grande do Sul to the Amazon was under the disease. In November the epidemic died out everywhere in Brazil; though it still continued in Guiana. In this, as in the preceding instances, the activity of the causes of cholera over the sea at the same time as at Fogo and on the coast of Brazil, is distinctly marked.

In 1866, when cholera was extending over Western Europe and this country, four steam-ships with emigrants left Liverpool for America. These were the *England*, which sailed on 28th March, the *Virginia*, which sailed on 4th May, the *Union*, which sailed on 12th May, and the *Peruvian*, which left Liverpool about the same time as the *Union*. The cholera had not commenced at Liverpool when these vessels left, and none of their passengers were known to be affected; but when they reached a point in the Atlantic close to 48 deg. 50 min. N., and 28 deg. 40 min. W., the disease broke out in each, and she carried it to her destination. About this time there was an unusual number of indications of cholera in ships at sea, extending nearly as far south as the Cape of Good Hope, and a fatal case of it in Cape Town itself. Thus the *Renown*, which left Gibraltar with troops for the Cape on 21st August 1865, had two attacks of cholera, and one death on 5th September, in 12 deg. N., 27 deg. W.; and five days after, in 6 deg. N., 22 deg. W., another outbreak commenced, which lasted till 19th September, during which there were fifteen attacks,

twelve of which proved fatal. The ship's position on the 19th was 14 deg. S. and 30 deg. W. The following troops, viz., 357 officers and men, and seventy women and children, embarked in the *Windsor Castle* at Gravesend on 11th July 1866, and sailed the following day for Kurrachee. A young man, who was embarked on 11th from the cells, drank three or four pints of porter before going on board; he was attacked with cholera on the 12th, but recovered. The first attack at sea was on the 18th, which proved fatal. On 22nd, diarrhœa increased remarkably, and a soldier was affected with cholera, who recovered. From the 29th fresh cases of cholera occurred, the ship being then about 32 deg. N., 19 deg. W., until the 20th August, when she was in 12 deg. S., 25 deg. W.; altogether, four men, two women, and two children died of cholera; the number of attacks was not given. The last case at this time occurred on 20th August, and died on 3rd October, in 34 deg. S. and 8 deg. W., from fever and hæmorrhage. A sailor of the crew died of a fresh attack of cholera on 25th September, when to the east of the Cape, in 37 deg. S., 39 deg. E. The *Lord Warden* left Portsmouth for India on 23rd September 1866, with 306 officers and men, and 61 women and children, besides the crew, and some other passengers. On 25th September the first case of cholera occurred, which recovered. On 26th there was another, which died. Up to 7th October a few cases of diarrhœa presented themselves, and from the 8th to 24th there were nine cases of cholera, all fatal. There were fifteen attacks in all, of which ten proved fatal. The names of the sick and dates of attack are not given. The ship's position on 8th October was 36 deg. N., 17 deg. W., and on the 24th, when the last case died, 8 deg. N., 21 deg. W. The *Jumna*, one of the new Indian steam troop-ships, was on her passage outwards in 1867. She had besides her crew a number of military officers on board, but no troops. On 17th July, four days after leaving St. Vincent, one of the Cape de Verde Islands, one case of cholera and six of choleraic diarrhœa occurred among the crew, and the diarrhœa continued to present itself till the 27th, by which date forty-six had been entered on the sick-list, besides some ten or twelve milder which were not. The ship's position on the 17th, at noon, was 6 deg. 35 min. N., 15 deg. 46 min. W., and on the 27th 19 deg. 37 min. S., 5 deg. 27 min. W. Some fresh beef obtained in England thirteen days before, and brought out in the ice-house, was issued to the crew on the 17th; the Marines, who used the beef, suffered more than the rest of

the crew, while the warrant officers, who refused it, escaped. One of the military officers had a severe attack of choleraic diarrhoea. There was no cholera at St. Vincent when the *Jumna* was there. H.M.S. *Vestal* had one of her crew attacked with cholera on 21st May 1867, as she was entering the Gambia. The ship *Newcastle*, proceeding to England, had a case of cholera midway between the Cape and St. Helena, in April 1866; and in Cape Town itself, a lady was attacked with cholera in October, collapse ensued, and she died with the characteristic symptoms of the disease.

While the manifestations just described were occurring along the eastern shores of the Atlantic, and in the vessels traversing it, cholera appeared in November 1865 at Guadaloupe, in the West Indies, and slighter indications of the same were met with in Dominica and Martinique. In Brazil, where cholera had not been met with since 1856, it again broke out, not on the sea-coast, but far inland at Corrientes, the point of junction of the rivers Parana and Paraguay, where the armies of Brazil and the Argentine Republic were watching that of Paraguay. The cholera appeared first in April 1866, in the army of Paraguay, but soon extended to the opposing forces, and to places in the neighbourhood; but it was thought it had been prevented extending to Buenos Ayres by strict quarantine, perhaps also by the intervention of the cool season. In January 1867 it commenced again and descended the river; but though there were slight manifestations of it at Buenos Ayres in December, the active progress of the epidemic was again stopped during the cool weather. In the summer 1867-68, however, it revived and attacked Monte Video, and extended afresh over the whole area that had already been affected by it, as well as much of the Monte Videan territory. It is difficult in the present state of the information regarding these varied outbreaks to analyse the facts so as to bring out completely the active causes, but it is obvious from what has been advanced above that the generally accepted reasoning, regarding causes and mode of propagation of cholera, require profound modification.
